

THE TOTAL SOLAR ECLIPSE OF JANUARY 3, 1908.

ON the third day of the approaching new year, according to Greenwich mean time, a total eclipse of the sun will take place, the line of totality passing from a point in the Pacific, about east longitude 155° and north latitude 12° , in a curved path through Polynesia and terminating in Mexico.

Unfortunately for astronomers and others who go far afield to make observations on these occasions, the eclipse is mostly restricted to the ocean, and the only two portions of land from which totality can be seen are two Pacific islands, namely, Hull Island, in the Phoenix group, and Flint Island, to the north of Tahiti.

The accompanying map, Fig. 1, gives a general idea of the path of the line of totality. It is taken from the "Nautical Almanac" for the year 1908, but has here been considerably reduced, and several lines which were not required for this article have been omitted, and the land areas more shaded.

The positions of the two islands to which reference above has been made are denoted by two small circles on the central line. Even these observing stations do not offer those facilities with regard to anchorage, landing, shelter, &c., which make eclipsing easy, as the following particulars, gathered from Dr. Downing's paper in the Monthly Notices of the Royal Astronomical Society, will show.

Hull Island has a lagoon and a little fresh water, and cocoa-nut trees 50 feet high grow on it. The island is surrounded by a coral reef, which makes landing very difficult except by entering the lagoon by means of the boat passages on the north-west side. There is also no anchorage.

Even Flint Island does not offer more enticing facilities. It is 13 feet high, and covered with brushwood and trees, and is $2\frac{1}{2}$ miles long and half a mile broad. Fringing it is a steep coral reef, which at low water is dry and extends seaward about half a cable. At the northern end of the island this reef extends seaward $4\frac{1}{2}$ cables, and at the southern end $2\frac{1}{2}$ cables. Two small lagoons of brackish water are situated in the interior. Landing also is described as very bad even for surf boats, and there is either bad anchorage or none at all.

So far as is known at present, no one intends going to Hull Island, but as Flint Island will be occupied the following data regarding the particulars of totality, gathered from the above-mentioned source, may be of interest. As the island is situated in longitude $151^{\circ} 48' W.$ and latitude $11^{\circ} 26' S.$, the duration of totality is 4 minutes. Such a long eclipse will be specially suitable for the study of some problems, and more especially for those connected with the corona. This station is also very favourable in another respect, because the sun at eclipse time has an altitude of 74 degrees, or only 16 degrees from the zenith.

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The following table shows the times of the four contacts of the moon with the sun in both Greenwich and local mean time.

<i>Mean Solar Time.</i>										
Greenwich						Local				
		d.	h.	m.	s.		d.	h.	m.	s.
(1)	January	3	7	52	51	January	2	21	45	39
(2)	"	3	9	22	44	"	2	23	15	32
(3)	"	3	9	26	44	"	2	23	19	32
(4)	"	3	11	2	59	"	3	0	55	47

While the accessibility of the station and the weather conditions are not all that could be wished for, the length of totality, the great altitude of the sun, and the importance of continuity of observation of eclipses are sufficiently tantalising to tempt astronomers to journey to this far-off land.

There is another reason which makes the observation of this eclipse of great importance.

The last eclipse from which successful results were obtained was that which occurred in 1905, the eclipse of 1907 not having been seen in consequence of unfavourable weather conditions. The next after 1908

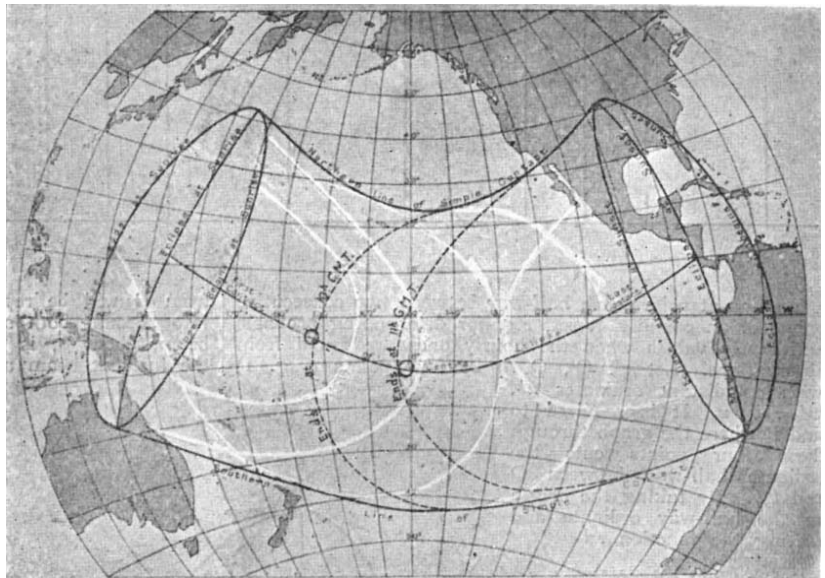


FIG. 1.—The track of the total solar eclipse of January 3, 1908. The small circles on the central line denote the positions of the two islands from which totality can be observed.

will be the eclipse of 1912, which will be visible from South America for one minute. The other eclipse which will take place in this interval are as follows:—

The Greenland and Siberian eclipse of 1909 is an annular one, and therefore not of any importance for physical astronomers.

An eclipse will occur in Tasmania in 1910, but as totality will commence at 4h. 35m. and end at 4h. 64m., and as the sun will set at 4h. 53m. Hobart mean time, the sun will probably be too low for any extensive series of observations.

In 1911 an eclipse track will begin in the south-eastern portion of Australia, pass across the Pacific Ocean, and finish by skirting the coast of Florida.

It may be that some islands lie in the track, in which case this eclipse can be utilised, but at the Australian end of the line the sun will probably have too small an altitude to warrant the sending of expeditions from great distances.

In April of 1912 there will be an eclipse visible in Spain, but until the calculations are published it

is not certain whether it will be "total" or "annular." This uncertainty is due to the fact that the apparent diameters of the sun and moon on that occasion will be so very nearly equal that it will depend on the value of the moon's diameter employed in the computations whether the sun will be totally eclipsed or not. Should it prove, however, to be total, the time of duration will probably be very short. Such an eclipse would most probably be a very valuable one from the point of view of the spectroscopic study of the chromosphere.

It will thus be seen that we shall most probably have to wait until October, 1912, for a favourable eclipse following that of 1908, so it is hoped that the approaching event in the Pacific will be satisfactorily observed.

The accompanying map of the world (Fig. 2) shows the tracks of all the eclipses to which reference above has been made, with the exception of that of April, 1912. This chart is taken from Mrs. Todd's excellent little book, entitled "Total Eclipses of the Sun" (1894), but all those tracks which were

Island and back. The ship put on this special duty is the *Annapolis*, and she will be under the personal command of His Excellency Governor Moore, U.S.N., of the Island of Tuituila, Samoa.

No doubt the officers and men of the *Annapolis* will prove most valuable assistants to Prof. Campbell, as they were found useful in the eclipse of 1905. On that occasion, it may be remembered, the United States Navy Department sent a "special eclipse squadron" of three vessels to Europe, under the command of Rear-Admiral C. M. Chester, U.S.N., the result of which was a complete series of observations only the preliminary results of which have as yet been published.

To describe briefly the scientific staff and instruments which will be conveyed by the *Annapolis*, reference has been made to the contents of an article which recently appeared in the *Journal of the Royal Astronomical Society of Canada* (vol. i., No. 4, p. 254) from the pen of Mr. C. A. Chant.

It is there stated that the party will probably consist of Prof. Campbell, with Messrs. Aitken, Perrine, and Albrecht, of the Lick Observatory; Prof. Lewis, of the University of California; Prof. Abbot and his assistant, and possibly one or two other assistants. They will all sail from San Francisco on November 22, arriving at Tahiti on December 4. The party will then join the *Annapolis* and sail for Flint Island.

With regard to the instrumental equipment, corona pictures on a large and small scale will be secured by a 40-feet focal length coronagraph pointed straight at the sun, and by a 5-inch objective of 70 inches focal length respectively. For the purpose of searching for intra-Mercurial planets, two groups of four cameras each will be pointed towards the east and west equatorial regions of the sun's surroundings. Objective-prism spectrographs, or prismatic cameras as they are often called, will be employed for obtaining photographs of the spectrum of the chromosphere. In one of these "running" plates will be

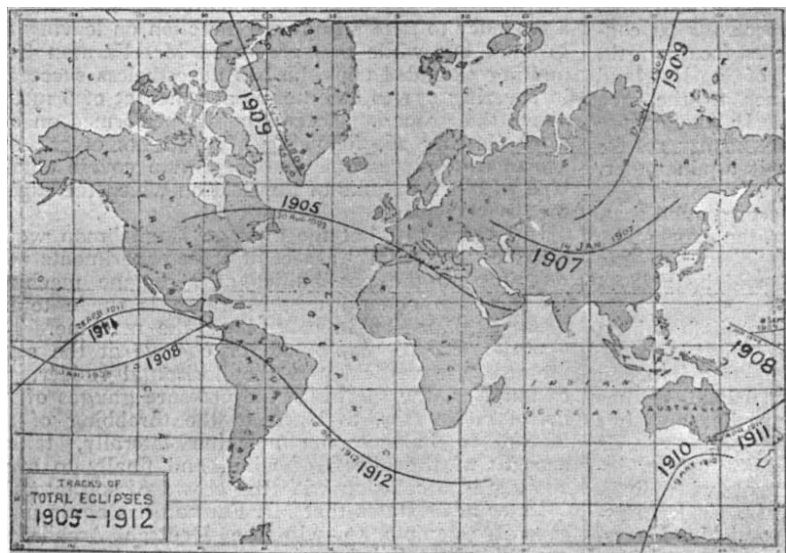


Fig. 2.—Chart showing the tracks of all the total solar eclipses from 1895 to 1912. The 1909 annular eclipse is included also, but the uncertain total eclipse of April, 1912, which might be seen from Spain, is excluded.

not required have been deleted, and the year of occurrence of each eclipse has been printed in larger type.

It is interesting further to point out that the eclipse of 1905 occurred at the time of greatest solar activity as indicated by the sun-spots, while that of 1912 will take place about the epoch of minimum sun-spots.

The eclipse of 1908, occurring in an intermediate year, will therefore be a useful connecting link between the two, and renders it important even from this point of view alone.

The only official expedition which, so far as is known, has made preparations to view this eclipse is the one from the Lick Observatory in America, under the direction of Prof. W. W. Campbell. Flint Island will be the observing station, and Mr. William H. Crocker, of San Francisco, who has defrayed the expenses of five previous expeditions, has again offered to finance this one. The Navy Department of the United States has come forward and provided a war vessel to transport the expedition from Tahiti to Flint

Island and back. The ship put on this special duty is the *Annapolis*, and she will be under the personal command of His Excellency Governor Moore, U.S.N., of the Island of Tuituila, Samoa.

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Other spectrographs included in the programme are one of low dispersion for recording the general structure of the corona, another for the determination of the wave-length of the green coronal line, and a third for studying the form of the gaseous envelope responsible for the green line. For the ultra-violet spectrum of the corona, Prof. Lewis is taking out a large quartz spectrograph. Polariscopic photographs will be undertaken, and a study of the brightness of the corona as a whole will be attempted.

From the above brief sketch it will be gathered

that Prof. Campbell's party is equipped with a fine set of instruments, and that it is prepared to cover a wide field of research.

Although the above will be the only official expedition to the island, an enthusiastic amateur in the person of Mr. F. K. McClean is already wending his way there. Mr. McClean is the son of the late Mr. Frank McClean, F.R.S., who, it will be remembered, besides completing a valuable spectroscopic survey of the brighter stars in both hemispheres, made valuable endowments both to the Cape Observatory and the Cambridge University.

At the eclipse of 1905 Mr. F. K. McClean accompanied the Solar Physics Observatory's expedition to Majorca as volunteer assistant. On that occasion he was in charge of a large coronagraph of 16 feet focal length, which he manipulated successfully, so he is not a novice at eclipse work.

For the coming eclipse he is taking out a fine 22-inch siderostat, one coronagraph, and a small grating spectrograph. The coronagraph consists of a 4½-inch De la Rue objective of 8 feet focal length, which has been used on numerous occasions during eclipses by the Solar Physics Observatory expeditions.

The optical parts of the grating spectrograph consist of a 4-inch Voigtländer of 42 inches focal length, and a Thorp's transparent replica of a Rowland diffraction grating having 14,500 lines to the inch and a ruled surface of 3×2 inches. In the eclipse of 1905 this instrument gave such satisfactory results that Mr. McClean wished to employ it again under, it is hoped, better weather conditions.

Mr. McClean has so arranged his programme that, failing any assistance at the station, he can make exposures in both the instruments. There is little doubt, however, that Prof. Campbell will be able to render him help should he require it.

It may be mentioned that if the *Annapolis* had been able to accommodate more than twelve of the eclipse party Mr. McClean would have been invited to join the Lick expedition. To reach Flint Island he has therefore gone to Auckland *via* Australia, and has chartered a special steamer to take him and his equipment to the island and back. From later information I find that, by arrangement with Prof. Campbell, he will pick up at Tahiti Mr. C. J. Mersfield, of the Royal Society of Sydney, and Mr. Moors, of the Sydney University, both of whom have volunteered to act as Prof. Campbell's assistants, and will convey them to Flint Island and back to Tahiti.

Let us hope that eclipse day will be fine, and that all will return with results which will add to our knowledge of the sun.

A cablegram, dated November 25, from Mr. McClean, at Auckland, states that Mr. Mersfield has joined him and will be attached to the Lick party. He further informs me that Mr. Raymond, of the Sydney Observatory, and Mr. Short, photographer to that observatory, together with the Rev. Mr. Walker, an amateur astronomer at Auckland, are going out with him and will form his party.

WILLIAM J. S. LOCKYER.

NEW AEROPLANES.

AN account of the successful aeroplane flights by which Mr. Henry Farman has succeeded in breaking the record hitherto held by M. Santos Dumont (in the absence of trustworthy information concerning the experiments of the Wright brothers) has probably been seen by most readers of NATURE in the daily papers. We are indebted to an article by M. René Doncière in *La Nature* for the further

details regarding the machine and its performances which form the subject of the present notice.

Mr. Farman's machine has been constructed in the works of Messrs. Voisin Brothers, and is of the well-known cellular form, as shown in the accompanying illustration. The front pair of planes measure 12×2 metres, the height between them being 2 metres. This pair is connected by a framework 4½ metres long with the rear pair of planes, which only measures 6 metres transversely. The vertical rudder is situated between the latter planes, while a horizontal rudder is fixed right in front of the machine. The motors and tanks of petrol are contained in a spindle-shaped case in front, into which is let the seat for the operator.

The motive power is furnished by an eight-cylinder "Antoinette" motor of 40-50 (metric) horse-power, and operates on a propeller the two vanes of which are 2·10 metres across and 1·10 metres in pitch. The whole apparatus rests on four wheels when on the ground. The total wing surface is 52 square metres and the weight 500 kilograms; the length of the machine is 10 metres. At present—or at any rate at the time of M. Doncière's account—the machine has a tendency to take an upward direction on leaving the ground, but while this prevented Mr. Farman from making extended trips, he has nevertheless succeeded in covering 771 to 800 metres at a height of 6 metres above the ground. These records, performed on and after October 26, following after flights of 303 and 350 metres, represented the maximum course obtainable within the limits of the field on which the experiments were made.

In regard to what the average Englishman would call the "practical" aspect of these experiments with reference to the possibilities of aeroplane machines coming into general use, reference is made to the great skill needed in controlling the machine. The operator has to manipulate or observe at the same moment the vertical and the horizontal rudder, the carburettor, the sparking, the pressure gauges of the petrol and water, to listen to the throbbing of the motor, to balance the machine laterally, taking account of the effects of wind, and finally to avoid coming into collision with the crowd of spectators.

Later news states that Mr. Farman has again made several attempts to win the Deutsch Archdeacon prize, but has failed to do so owing to the wheels of his machine grazing the ground, especially in the neighbourhood of the turning points.

Another aeroplane which is also attracting considerable attention at Paris is the "monoplane" of M. Robert Esnault Pelterie. This, unlike most recent types, has only a single transverse supporting surface, which in one machine measured 9·6 metres from tip to tip with a superficial area of 18 square metres; in a more recent machine these dimensions have been reduced to 8·6 metres and 16 square metres respectively. The surface is somewhat concave in form. In addition there is a single horizontal rudder placed at the rear, while the motor and propeller are in the front of the machine. The motor consists of seven cylinders arranged round a circle, and it gives 25 to 30 horse-power with a weight of 44 kilograms. The total weight of the machine and its rider amount to 240 kilograms. For running along the ground the monoplane has two wheels, arranged bicycle-fashion, attached to the body, and two other wheels are attached to the tips of the wings. The recorded performances, which commenced on October 22, include straight flights of about 100 metres and 147 metres, and a path stated to be a semicircle of radius about 1640 feet, which, if correct, represents a flight of, roughly, 1600 metres. But at the end of the flight of 147